

REMARKS

Please reconsider the application in view of the above amendments and the following remarks. Applicant thanks the Examiner for carefully considering this application. Further, the Applicant thanks the Examiner for the courtesies extended during the telephone interview dated April 28, 2003. While no agreement was reached with respect to claim 3 of the instant application in view of U.S. Patent No. 6,429,102 (“the ‘102 patent”), the Examiner indicated that the ‘102 patent did not disclose a temperature range of approximately 400-500 degree centigrade for activating a P type impurity. Further, the Examiner acknowledged that the ‘102 patent failed to disclose irradiating under an atmosphere of normal air, in contrast to an atmosphere of nitrogen as taught by the ‘102 patent. Favorable reconsideration of this application is respectfully requested in view of the above amendments and the following remarks. In addition, the Applicant requests that the Examiner consider the attached Information Disclosure Statement.

Disposition of Claims

Claims 3-9, and 15 are pending in this application. Claim 15 has been cancelled without prejudice or disclaimer. Claim 3 is independent. The remaining claims depend, directly or indirectly, from claim 3.

Rejection(s) under 35 U.S.C § 102

Claims 3-9, and 15 stand rejected under 35 U.S.C. § 102(e) as anticipated by U.S. Patent No. 6,429,102 (hereinafter “Tsai”). Claim 15 has been cancelled in this reply.

Thus, this rejection is now moot. Independent claim 3 has been amended in this reply to clarify the present invention recited. To the extent that this rejection may still apply to the amended claims, the rejection is respectfully traversed.

Amended claim 3 recites a method for manufacturing a GaN compound semiconductor element including activating a P type impurity by applying thermal energy which is approximately 400-500 degree centigrade to the P type impurity in an atmosphere of normal air while irradiating the GaN compound semiconductor layer.

The temperature range of 400-500 degree centigrade is significant to the embodiments of the present invention because, as described on page 8 of the instant application, the resistivity of Mg-doped GaN starts to decrease when annealed while heating to 400 degree centigrade or higher (as disclosed in Japanese Patent Laid-Open Publication No. Hei 10-178213). At a temperature lower than 400 degree centigrade, the H-bonded structures are not sufficiently dissociated, resulting in high resistivity of the GaN material such that the material cannot satisfactorily function as a P type semiconductor.

Further, if the heat treatment is performed at a temperature exceeding 500 degree centigrade, it would be necessary to create an atmosphere of an inert gas such as nitrogen gas because the material would react with the ambient gas. As disclosed on page 8 of the instant application, at a temperature below 500 degree centigrade, the heat treatment can be performed in an atmosphere of normal air, advantageously allowing mass production and cost reduction.

Moreover, when an electrode is to be formed on a GaN compound semiconductor of the present invention to fabricate an LED, for example, the heat treatment is performed

at about 500 degree centigrade. By dissociating H at below 500 degree centigrade to activate Mg, it is possible to conduct the Mg activation after forming the electrode, thereby possibly improving efficiency of the fabrication process. The ohmic characteristic of the electrode would be lost if a heat treatment is performed at a temperature exceeding 500 degree centigrade after formation of the electrode.

As described above, the lower limit of 400 degree centigrade is the temperature necessary for activating Mg, and the upper limit of 500 degree centigrade is the temperature which permits performing the processing in an atmosphere of normal air, and allows conducting Mg activation after forming an electrode while maintaining the ohmic contact of the electrode.

Tsai is silent as to activating a P type impurity by irradiating an electromagnetic wave while heating within a temperature range of approximately 400-500 degree centigrade. Also, Tsai specifically makes reference to reducing the resistivity of the P type GaN by an annealing process in a nitrogen atmosphere (col. 1, lines 34-40, and col. 1, line 66 to col. 2, line 2)

In view of the above, Tsai fails to show or suggest the present invention as recited in amended claim 1. Thus, the amended claim 1 is patentable over Tsai. Dependent claims are allowable for at least the same reasons. Accordingly, withdrawal of this rejection is respectfully requested.

Rejection(s) under 35 U.S.C § 103

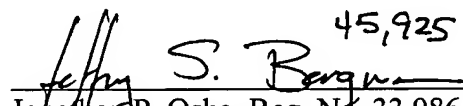
Claim 15 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Tsai. Claim 15 has been cancelled in this reply. Thus, this rejection is now moot.

Conclusion

Applicant believes this reply to be fully responsive to all outstanding issues and place this application in condition for allowance. If this belief is incorrect, or other issues arise, do not hesitate to contact the undersigned or his associates at the telephone number listed below. Please apply any charges not covered, or any credits, to Deposit Account 50-0591 (Reference Number 08228.020001).

Respectfully submitted,

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